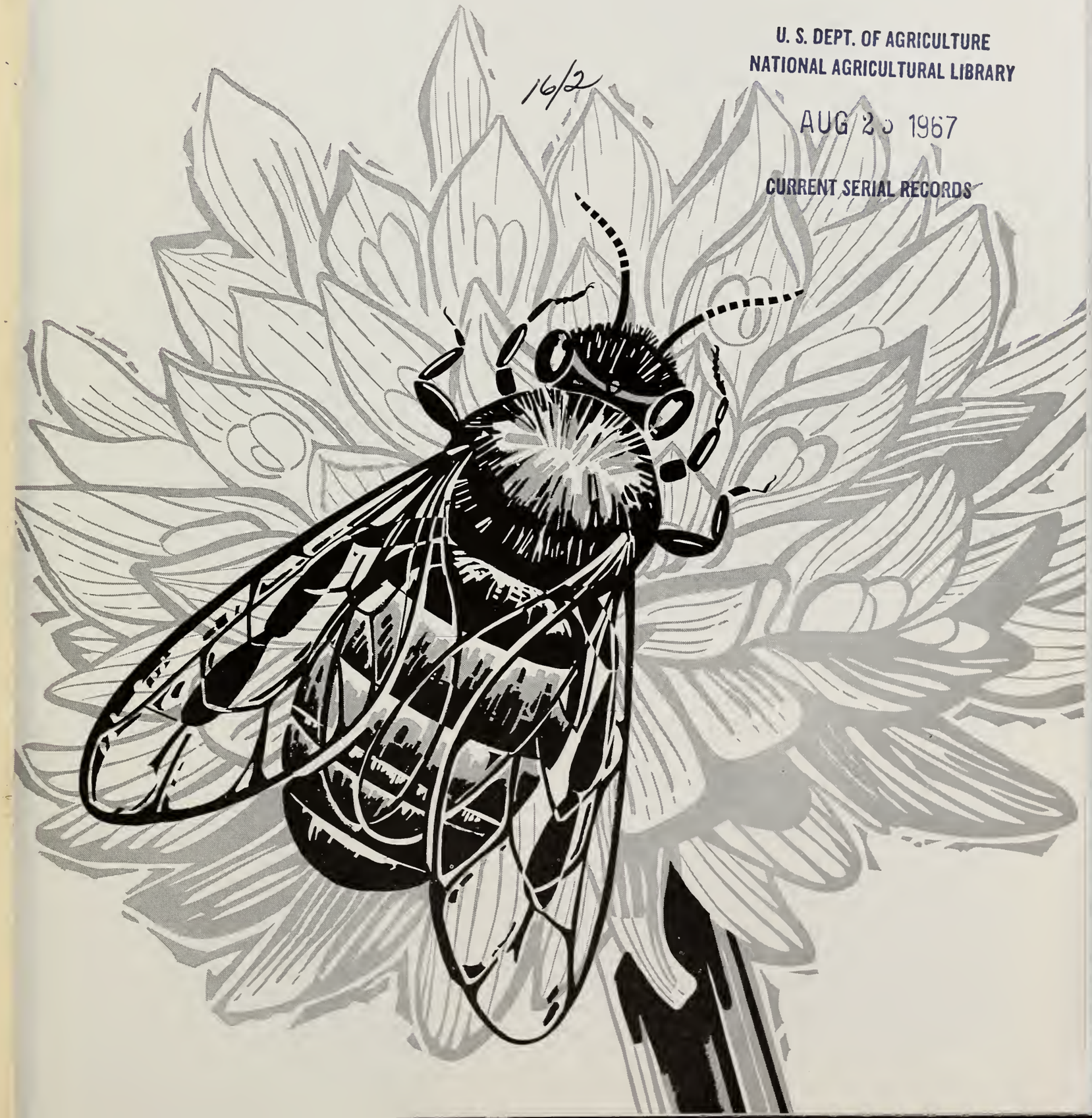
AGRICULTURAL
Research
U.S. DEPARTMENT OF AGRICULTURE

AUGUST 1967



AGRICULTURAL
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August 1967/Vol. 16, No. 2

To Revitalize Beekeeping

It's *making* honey that's really important.

Although bees are our only source of honey and beeswax, their vital role is that of pollinator, a function essential to fruit and seed production in more than 50 farm crops worth $1 billion annually.

On the other hand, honey must be a profitable item for beekeepers, or pollination suffers. Unfortunately the price of honey has remained nearly constant during the last 20 years, while the cost of honey production has steadily increased.

That's why increasing the efficiency and income of beekeepers is an important—perhaps vital—goal of ARS bee research. Our scientists are tackling the income squeeze from many angles:

- Breeding *improved* bees with special characteristics. ARS scientists have bred a line of bees that prefer alfalfa pollen (p. 8). This accomplishment means that other specialty bees are possible.
- Studying bee diseases to find practical and economical ways to control diseases and pests that invade the hive. ARS scientists looking for ways to save disease-infected equipment instead of destroying it, found that ethylene oxide gas may be useful in sterilizing hives infected with American foulbrood disease (p. 9).
- Finding ways to utilize the bee more effectively. Synthetic compounds that act as queen substitutes to hold the mass of bees together, for example, might lead to use of less expensive queen-less packages of bees for pollinating crops with a short flowering period.
- Mechanizing beekeeping operations to cut honey production costs. Using power hoists to load hives when moving to different nectar sources can increase efficiency, for example.
- Protecting bees from pesticides. Tests show that some pesticides are less harmful to bees than others. Using these and nonchemical control methods can mean more honey and better pollination.

Other projects include studies of plants to determine how many bee visits each flower needs or to increase the amount of nectar in new varieties; of pollen and bee nutrition to ensure a strong colony of bees when needed; and of conservation practices that incorporate nectar and pollen plants into wastelands, watersheds, and roadsides which could open new forage ranges for bees.

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AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service (ARS), United States Department of Agriculture, Washington, D.C. 20250. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is $1.50 in the United States and countries of the Postal Union, $2.00 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Information in this periodical is public property and may be reprinted without permission. Mention of the source will be appreciated but is not required.

Orville L. Freeman, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

Faster Test for
SALMONELLA

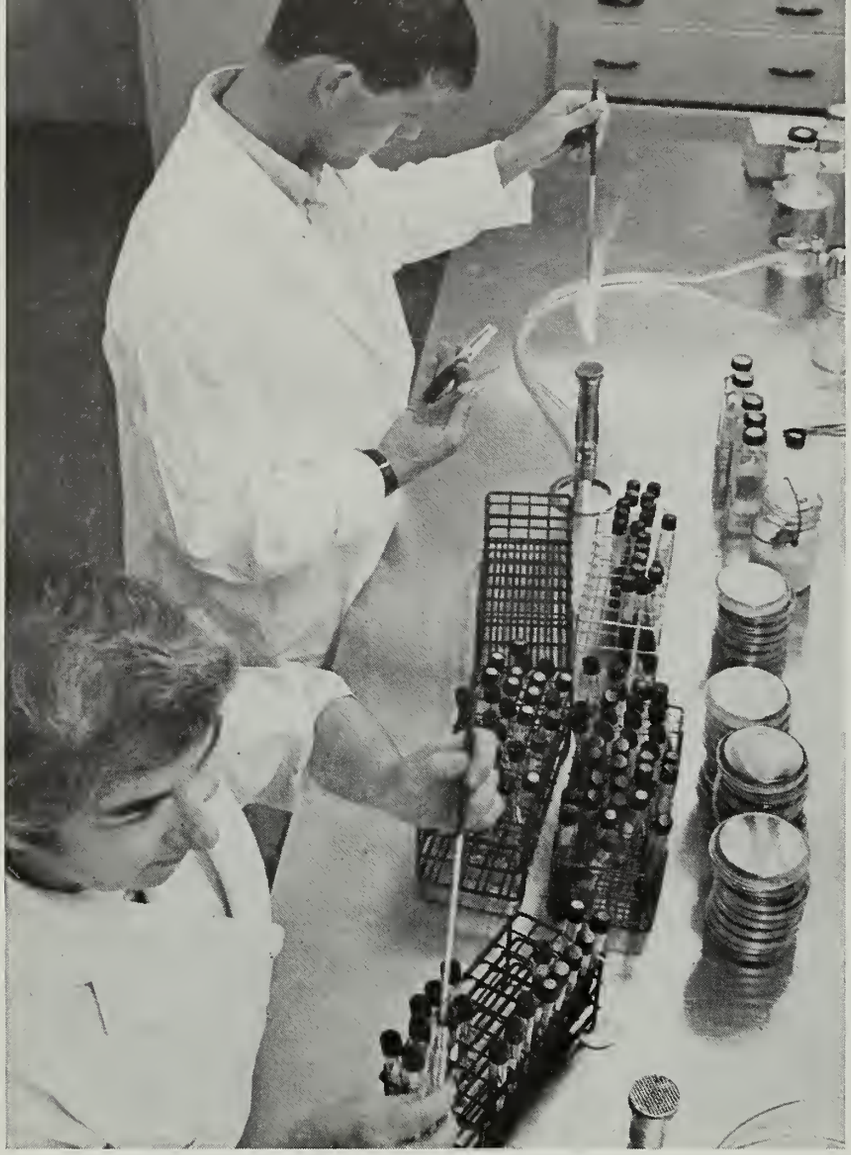
Laboratory technician Madeleine Kreitzer checks results of the last test required for samples showing positive Salmonella *reactions during the test series.* ST-2567-29

A NEW LABORATORY technique may cut 2 days off the time it takes to test pasteurized, dried whole egg for *Salmonella.*

Hundreds of different types of *Salmonella* organisms occur throughout the world and cause bacterial disease in both men and animals. To kill these and other bacteria, the USDA has required pasteurization of all egg products moving in interstate commerce since 1966. The pasteurized eggs must be tested to detect inefficient pasteurization or post-pasteurization contamination.

The new technique, now being tested commercially, was developed by ARS microbiologist G. J. Banwart at Beltsville, Md. It promises to save laboratory space, labor, and shipping delays.

In the conventional method, a sample of dried egg is added to a lactose broth. After a 24-hour incubation period, 10 milliliters of the broth are added to a solution of selenite cystine and tetrathionate-brilliant green broth for an additional 24-hours. A portion of the new mixture is then streaked on a selective agar surface; this is incubated another 24 to 48 hours and observed for a color change that indicates *Salmonella.* Thus, a 72- to 96-hour period is required to determine if the sample is *Salmonella* negative—no reaction occurs.



ST–2566–10

Laboratory helper John Quest and Mrs. Kreitzer prepare positive samples for further testing after Banwart's method eliminated about two-thirds of the samples within 42 hours.

Banwart's method is based on two characteristics of *Salmonella*—it produces hydrogen sulfide, and causes fermentation of mannitol. The new method starts the same way as the conventional method, except that Banwart adds two test tubes containing indicators to the jar with the egg and lactose broth.

One tube contains a medium (SIM) that turns black when hydrogen sulfide is produced by the bacteria. The other test tube contains a mannitol (sugar-like) material with a purple pH indicator that turns yellow if the mannitol ferments and produces increased acidity.

These two tests do not prove the presence of *Salmonella*, but if neither reaction occurs, it proves the sample is *Salmonella* negative. Samples showing a positive reaction must be tested further with other media as in the conventional method.

Banwart tested 225 samples of dried whole egg with the new method and found 145 of them to be *Salmonella* negative within 42 hours. Further testing of the samples not cleared showed that eight actually contained *Salmonella*. In contrast, using the conventional method, it took him 90 hours to clear 118 samples.■

LONGER

THE BEAUTY THAT ought to last forever may at least last a few days longer with some cut flowers in controlled atmosphere storage.

Refrigeration is the most common and best understood method for preserving fruit, vegetables, and flowers. But modified storage atmospheres containing combinations of oxygen, nitrogen, and carbon dioxide different from those found in air have proven a valuable supplement for some commodities when refrigeration is not available.

If modified atmospheres can also help maintain flower quality at reasonable cost, growers, handlers, and retail florists may be able to extend the market season and reduce spoilage losses. In addition, the storage could assure a plentiful supply of flowers during holidays and reduce the surpluses that might occur at other times.

In most studies so far, flowers stored in low-oxygen atmospheres kept slightly better than flowers stored in air. The ultimate test, however, is: Do stored flowers compare favorably with freshly cut flowers? Only daffodils have met this test.

Daffodils will keep in good condition for more than 3 weeks when stored dry in 100 percent nitrogen at 32° F. They then last about 5 days on display—a day longer than freshly cut daffodils. Under conventional storage methods, daffodils held 3 weeks lasted about 3½ days on display. (AGR. RES., November 1964, p. 4).

In tests with carnations, gladiolus, roses, and lilies, the carnation studies, conducted at the ARS horticultural field station, Fresno, Calif., provided the most significant results.

With carnations, the low-oxygen atmospheres helped preserve freshness and reduce the spread of botrytis rot.

LIFE FOR CUT FLOWERS

Immediately after storage, the blooms held at 36° and ½- and 1-percent oxygen atmospheres were significantly superior to those held in air. After 4 days on display, however, blooms held in continuously flowing fresh air appeared about the same as those stored in low-oxygen atmospheres.

These findings are significant because carnation blooming cannot be manipulated as it can with some flowers. Carnations of a given planting are usually harvested and marketed within 3 or 4 days. Large surpluses occasionally occur because the flowers can be held for only 1 or 2 weeks with present storage practices. Even in this short period, there is some quality loss.

Because of the good results with ventilated fresh air, low-oxygen storage is probably not economically feasible unless decay is a problem or nitrogen, used to replace oxygen in the atmospheres, is available at low cost.

For the tests, White Sims, Linda, and Scania carnation varieties were cut and placed in storage chambers at 32° to 36° F. Relative humidity was near 100 percent in each chamber. Atmospheres tested were static air, continuously flowing fresh air, and oxygen atmospheres of ½, 1, and 2 percent. Carbon dioxide mixtures of 5, 10, and 15 percent in combination with one-half of 1 percent oxygen were also tested, but they did not improve the quality of the blooms.

After storage, the stems were placed in water for 24 hours at 45° F. to condition the blooms. Then they were held at 70° to determine vase life. Quality evaluations were made at daily intervals.

In atmosphere tests with gladiolus, poststorage blooming ability was best in an atmosphere of 5-percent carbon dioxide and 1 percent oxygen. In packaging tests, gladiolus were kept successfully for 6 to 8 days in sealed polyethylene bags at both 32° and 40° F. The film prevented moisture loss while respiration of the flowers inside the bag created a beneficial atmosphere of about 4-percent carbon dioxide and 12-percent oxygen.

With roses, the most promising results have been with vented polyethylene box liners used in air transport when refrigeration is not available. The liners were flushed with nitrogen to produce an atmosphere of about 7-percent oxygen. This treatment retarded bud opening for 24 to 36 hours without injury when transit temperatures were around 60° F. When transit temperatures were below 40°, low oxygen was not necessary to retard bud opening.

In general, vase life after low-oxygen storage of the rose varieties tested was not improved.

Lilies stored in low-oxygen atmospheres held up much better than those held in normal air, and the atmospheres gave good control of botrytis rot. However, fresh lilies were much superior to those stored in low-oxygen atmospheres.■

PN–1526

ARS horticulturist C. S. Parsons removes daffodils from a storage tank after 4 weeks in a 100-percent nitrogen atmosphere.

Meals, Not Mealtime Routines

Affect Weight Gains

PN–1527

AS LONG AS WEIGHT-WATCHERS control the amount and kind of food they eat, it doesn't matter whether they eat two light meals and a heavy meal, three meals of equal size, or even six meals a day spaced through the waking hours.

This was the major conclusion from experiments by the ARS Human Nutrition Laboratories, Beltsville, Md., with 15 coed volunteers. Groups of five girls took turns eating their meals in three routines, each lasting 20 days. The routines were: Breakfast at 7:15 a.m., lunch at 12:15 p.m., and dinner at 5:15 p.m., with one-quarter of the daily diet served at breakfast, one-quarter at lunch, and the remaining one-half at dinner; three meals at the same times as above, but with equal portions; six equal (but smaller) meals at 7:15 and 9:45 a.m. and 12:15, 2:45, 5:15, and 7:45 p.m.

The total daily food intake was the same on all routines. Meals consisted mainly of muffins baked from a special batter containing nutrients in specific proportions. The muffins were supplemented with orange juice, butter, and jelly.

After allowing 5 days for the volunteers to get used to the change in diet and eating schedule, ARS nutritionist M. I. Irwin checked body

Above: Sue Steere, Hyattsville, Md., one of the 15 coed volunteers in the trials, also worked in the ARS Human Nutrition Laboratory and is shown filtering samples for mineral analysis. Below: Doris Bucher, Myerstown, Pa., and Carol Neely, East Lansing, Mich., prepare muffins eaten by the student volunteers.

BN–23766

wastes for evidence of changes in food metabolism. She found that regardless of eating routines, the volunteers used protein, fat, minerals, and vitamins to essentially the same extent.

The only significant difference uncovered by the test was that blood serum cholesterol of the subjects was slightly higher when they ate two light meals and a heavy dinner than when they ate three meals of equal size, although serum cholesterol and other fat metabolites in the blood rose on all routines.

The rise in cholesterol on all routines may have been due to the high-egg content of the muffins, which brought the cholesterol level in the test diet to approximately 1 gram per day. The rise may also have been accelerated by the sugar in the test diet, which made up 56 percent of the carbohydrates. This supposition is based on results from earlier studies at Beltsville that showed that serum cholesterol of rats was higher on a diet of egg plus sugar than one with egg plus starch.

There was also some indication in the trial that eating the largest meal in the evening possibly enhances protein metabolism.

Nitrogen retention—an indication of efficiency in utilizing protein—was greater when the girls ate three unequal meals than when they ate three equal meals, but this difference is not statistically significant, however. Because the girls on the routine with three meals of unequal size ate their big meal in the evening, they may have been sustained more adequately during the night than the girls eating a smaller dinner as part of three equal meals.■

WHEY: Now An Asset

WHEY, THE UGLY duckling of the dairy industry, may be about ready to spread its wings and take flight as the long-sought swan.

Although Little Miss Muffet ate the whey along with the curds, U.S. cheesemakers have been able to use only limited amounts of this low-cost, high-nutrition byproduct of cheese manufacture. Up to now, more than half the 7 billion pounds of whey was discarded, which created serious waste disposal problems. The rest was used to feed hogs or fertilize fields, or it was dried for use as a dried skim milk substitute when the price of dried milk got too high.

With the severe food shortages in developing countries, however, dried whey could become a valuable addition to U.S. aid programs. ARS, State, and industry researchers are looking for the best ways to adapt whey to the diet of children in the Far East and South America.

The U.S. market for dried whey is being increased by the addition of this byproduct in specialty foods. Not only does dried whey improve the nutritional value of foods, it also adds other desirable characteristics. Dried whey in enriched white bread, for example, gives bread a golden color when toasted. For this and similar reasons, dried whey is now being used in hot roll mixes, pop-tarts, frozen baked potatos or frozen vegetables with cheese sauce, sour cream sauce, candy and cookies, frozen cream pies, instant western omelets, frozen fish sticks, and frozen macaroni and cheese.

ARS scientists recently reported on the use of dried whey in ice pops. The inclusion of only 2.6-percent whey in the mix reduced the acidity of the ice pops to a level that British researchers found effective in reducing tooth decay caused by consumption of water ices. Thus, the addition of whey not only makes the ice pops far more nutritious but also alleviates tooth decay associated with their consumption.

There are two types of whey produced in cheese manufacturing—sweet rennet whey, the byproduct of Cheddar, Swiss, or other "sweet-type" cheeses; and cottage cheese whey produced from the manufacture of farmer, pot, cottage-type cheeses.

Cottage cheese whey was first successfully spray-dried by a process developed by ARS scientists in 1961. Since then, interest has grown in the utilization of this product, which could be produced at the rate of 450 million pounds a year with an estimated value of $40 million.■

PN–1528

RESEA

BREEDING FO

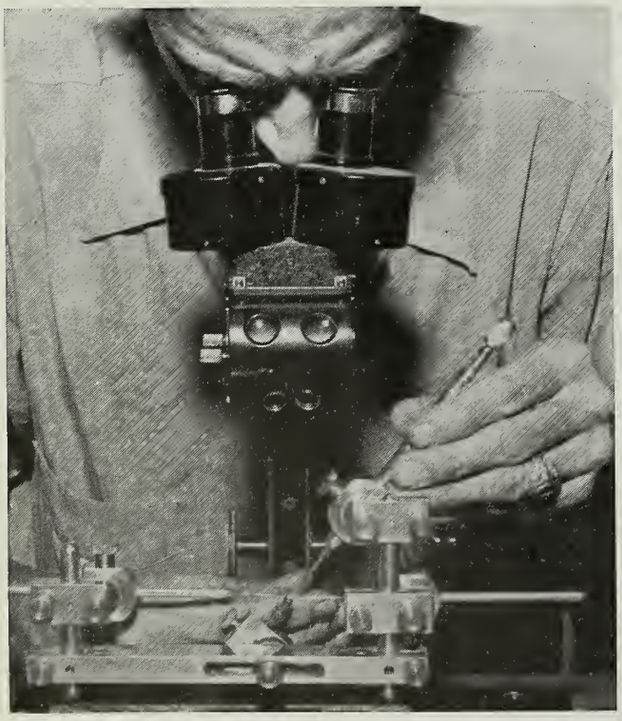
INSTEAD OF DIVIDING their attention among a variety of flowering plants, honey bees bred for crop preference may someday head straight for blossoming alfalfa—or other "target species."

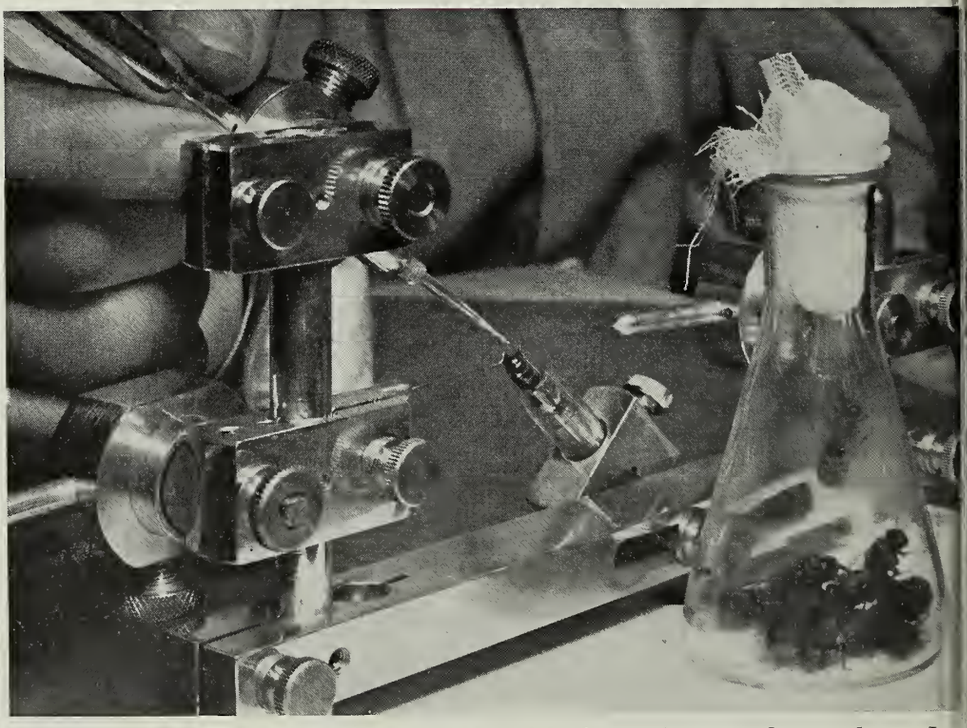
In bee breeding experiments at the ARS Laboratory in Baton Rouge, La., entomologist Otto Mackensen discovered that alfalfa preference is an inherited trait, then bred bees for this trait. Alfalfa crop preference of a line of bees bred by Mackensen was confirmed in Utah alfalfa fields by ARS entomologist W. P. Nye.

Mackensen's line gathered more alfalfa pollen than other bees, which spent more time searching for different flowering crops.

Pollen not only fertilizes flowers, it

PN–1529





The alfalfa-preferring line of bees is developed by artificial insemination of queen bees with the equipment shown above. In the photo at right, the queen bee is held in the center block. Hooks extending from the sides gently separate the opening to the queen's sexual organs, and a researcher applies semen from the syringe above the bee. (National Geographic *close-up photo*).

CROP PREFERENCE

also serves as food for the bees. They store it in honeycomb cells in the hive, then combine it with honey to make bee bread for the colony.

Honey bees were selected for alfalfa preference from 356 hives. Forty percent of the pollen collected by their offspring was from alfalfa blossoms. By inbreeding the bees, alfalfa pollen preference was increased to 85 percent by the fifth generation and may be further increased in future breeding experiments.

To develop a commercially acceptable line of bees, breeding for crop preference will be expanded to include such desirable factors as good bee temperament, vigor, disease resistance, and high brood and honey production capacities.

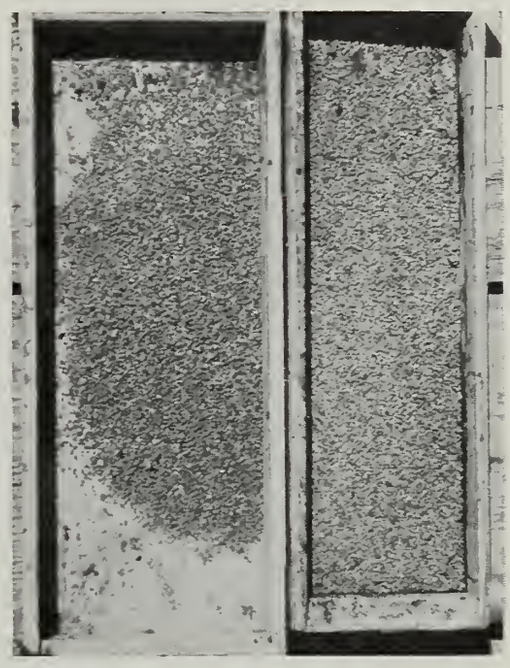
Genetic studies will also be expanded. Tests so far indicate that the trait for crop preference is a result of factors carried on a number of genes.

Scientists also want to find out if other lines of bees have preferences for different crops and whether these preferences are inherited. A preference for cranberry pollen in some bees has been found, for example, and studies are underway to determine if it is inherited.

Other crops that require bee pollination—hybrid cotton and red clover for example—might profit from bees bred to prefer their blossoms over other flowering crops.

The Louisiana and Utah Agricultural Experiment Stations cooperated in the research.■

PN–1531



Alfalfa pollen collected by a control bee colony (left) and by a colony of the new line of alfalfa bees (right).

CONTROLLING FOULBROOD

AMERICAN FOULBROOD, a destructive bacterial disease of honey bees, may be controlled by treating hive equipment with ethylene oxide gas.

Microbiologist Hachiro Shimanuki, at the ARS Laboratory, Beltsville, Md., found that various gas treatments kept bee colonies free of American foul-brood for as long as 8 months. In comparison, a colony equipped with untreated supers (parts of the hive in which bees store honey) developed the disease within 2 weeks after the equipment was placed in the hive.

Best results occurred when Shimanuki placed a group of four supers on a plywood board and covered them with a plastic tarpaulin. Edges of the tarpaulin were sealed with soil and openings provided for discharge of air and addition of the gas. After gas was added, the tarpaulin was completely sealed for 26 hours.

Because pure ethylene oxide will burn, it was combined with another gas to make the mixture nonflammable. Shimanuki used a commercial mixture of 12 percent ethylene oxide and 88 percent dichlorodifluoromethane.

Better results can be obtained during warm—(80° F.) weather than in cool. Residues of the gas that might be harmful to the bees were removed by holding the supers in a room heated to 106° F. for 24 hours.

Seven colonies with fumigated equipment were still free of American foulbrood after 8 months. Other colonies equipped with the treated supers—plus other supers fumigated in stacks—remained free of disease longer than bees equipped with untreated supers.

Shimanuki plans additional tests before the treatments will be recommended to beekeepers. More information will be obtained on the best temperature, humidity, kind of tarpaulin, and level of gas needed, among other factors affecting successful fumigation.

Other promising preliminary findings will also be studied further. For example, the treatments show promise for controlling Nosema disease, which attacks adult bees; European foulbrood, which attacks immature bees; and the greater wax moth, which also destroys colonies.

The Arizona Commission of Agriculture and Horticulture is cooperating in the ARS experiments.■

Mechanized all-purpose

BEE HIVE HANDLER

A fieldworker uses the beehive manipulator to weigh colonies. Hydraulic stabilizers and control valves are in the rear of the vehicle.

PN–1532

BEEKEEPERS WITH large numbers of colonies may soon be able to take things a little easier around the apiary.

ARS agricultural engineer B. F. Detroy and apiculturist F. E. Moeller at Madison, Wis., have designed and built a vehicle that takes much of the manual labor out of lifting and manipulating heavy hives. It also provides a ready source of electrical power for operating hand tools and other equipment—an important feature because most colonies are set out far from an electric power supply.

The experimental vehicle is a modified pickup truck equipped with four-wheel drive, heavy-duty axles, power takeoff, and automatic engine speed controls. Auxiliary equipment includes a boom, air compressor, electric generator, and a hydraulic system.

The four-wheel drive and heavy-duty axles enable the beekeeper to reach colonies located on rough, rocky terrain almost impossible to reach with other vehicles. Hydraulic stabi-

ELECTRIC VALVE FOR EFFICIENT FILLING

BEEKEEPERS WHO USE 60-pound cans to market their honey will save time and effort with an ARS-developed electric can-filling valve.

Unlike a manually controlled valve, the electric valve eliminates the need for an operator to remain with the unit or to keep it under close observation. It was designed and built by ARS agricultural engineer B. F. Detroy, cooperatively with the Wisconsin Agricultural Experiment Station, Madison.

Normally, about 1 minute of an operator's time is required to fill a 60-pound can from a 2,000-pound bulk tank of honey at temperatures between 95° and 100° F. In tests last year with the new valve, only about 25 seconds of the operator's time was needed.

The valve is tubular and contains a disk gate and a stainless steel bellows with stem running down the core. The valve and an electric solenoid are mounted on the bulk tank. The weighing beam of the scale activates the cut-off switch. The 60-pound can rests on the scale.

In operation, the scale beam is down, closing the switch and completing the circuit of electricity to the solenoid. The solenoid then lifts the valve stem which compresses the bellows and opens the disk gate, allowing honey from the bulk tank to flow through the valve into the can.

As honey fills the can, the scale beam rises. At 60 pounds, the beam opens the switch breaking the circuit of electricity from the solenoid. The stem is then released, and the valve closed.■

lizers on the rear of the machine allow some degree of leveling when the truck is operated on slopes.

With the boom, an operator can move and load colonies of bees, supers of honey, and complete hives. Some colonies weigh more than 600 pounds when a two-queen system of management is used. Mechanical handling makes this type of management more acceptable. A scale above the boom aids in making spring and fall colony weight checks.

The air compressor permits use of paint spraying equipment at the apiary and could be used to remove bees from the supers when harvesting the honey.

The 3,500-watt electric generator provides ample power for operating small fans, blowers, and pumps used in spring feeding, honey removal, and other management operations.

Not yet available commercially, the machine is being developed in cooperation with the Wisconsin Agricultural Experiment Station, Madison.■

PN–1533

The valve permits viscous honey to flow from the bulk tank with minimum restriction. On top of the valve is the solenoid assembly.

CLIPPING TOMATO TRANSPLANTS

CLIPPING TOMATO transplants in the field may become a valuable management practice by helping southern transplant producers program their harvest to the needs of northern tomato growers.

Frequently, transplants are ready but because of inclement weather, tomato growers are not.

ARS soil scientist C. A. Jaworski and plant pathologist R. E. Webb ran clipping trials with tomato variety H–1350 at Leipsic, Ohio; Beltsville, Md.; and Swedesboro, N.J. Clipping did not affect survival, number of fruit-bearing branches, or fruit yields when transplants were allowed to regain their vigor. The researchers found that in 14 to 16 days the cuts healed and new growth started.

Lack of uniformity in the size of transplants has been a major obstacle to harvesting them by machine. Clipping substantially improved uniformity in the trials and, coupled with sound cultural practices, would allow machine harvesting. Jaworski and Webb believe that with machine harvesting, producers could increase yields from about 125,000 marketable transplants per acre to 800,000 per acre and reduce trips across the field from several to only one.

Transplant producers in southern Georgia produce over 700 million transplants each spring to meet the needs of growers in the East and Midwest. During the planting season, unfavorable weather conditions often force tomato growers to delay setting out transplants.

When this happens, transplant producers harvest their transplants unclipped and store them until weather conditions become suitable. Pulled and stored, transplants become dormant and grow weaker as storage time increases.

Clipped transplants, however, continue to draw nutrients from the soil and grow stronger. In the trials, clipped transplants generally performed better than stored. unclipped ones. In addition, the clipped transplants developed thicker, stronger stems and withstood transplanting shock better.

Although the trials indicated that there are only advantages to clipping tomato transplants, Jaworski and Webb caution that other varieties may respond differently than H–1350. In future trials, the scientists plan to test other varieties and investigate the effect of clipping on plant diseases.■

WATER MULCHES

PLASTIC BAGS FILLED with water and laid on the soil as a mulch improved vegetable yields by 20 percent on an experimental plot in Idaho.

The water mulch cut down the variation in soil temperatures, absorbing some of the heat from the sun at midday and reducing heat loss from the soil at night. Most vegetables grow best within a fairly narrow range of soil temperatures. Water mulches would allow gardeners to plant early in the spring with less risk of frost damage and should be especially useful where the temperature varies sharply during the growing season.

S. A. Bowers, ARS soil scientist at the Snake River Conservation Research Center in Kimberly, Idaho, first tested his water mulch theory on uncropped soil.

He found that the water bags reduced maximum temperature and increased minimum temperature in the surface half inch of soil. At a soil depth of 4 inches, the bags raised both maximum and minimum temperatures.

Bowers then tried the new mulching idea on two heat-sensitive crops: sweet corn and string beans. He planted 12 plots of each vegetable, four mulched with water bags, four with plain strips of plastic, and four without mulch. Average yields for sweet corn were, respectively, 28,000 pounds, 24,000 pounds, and 16,000 pounds per acre from the three treatments. Bean yields were 17,000 pounds, 14,000 pounds, and 9,000 pounds per acre.

The advantages of the water mulch were best demonstrated during an unseasonable cold snap, Bowers said. One September day during the experiment, snow fell and air temperatures dropped from the mid-40's to 24° F. Minimum soil surface temperatures were 32° F. on the unmulched plots, 36.7° F. on the plots mulched with plastic strips, and 40.7° F. on the water-mulched plots.

Bean plants planted on the unmulched and on the plastic-mulched plots froze down to the soil line, killing the plants; water-mulched beans froze only to the tops of the water bags—about 4 inches from the ground. Two weeks after the freezing weather, fresh beans were harvested from the water-mulched plot.

Bowers used plastic bags made of 6-mil clear polyethylene, cut 12 feet long and 2 feet wide to fit between the rows on his 12- by 12-foot test plots. The bags were filled with enough water to swell them to a thickness of about 4 inches. The plastic-mulched plots were covered with strips of the same clear polyethylene.

Golden Beauty sweet corn and Garden Green bush beans were used in the experiment; 100 pounds of nitrogen per acre was disked into each plot prior to planting. Thermocouples were buried at varying depths in the plots to record soil temperature.

The Idaho Agricultural Experiment Station cooperated in the research.■

PN–1534

A fieldworker stands in a check plot of corn that did not receive mulch treatments (left) and in a test plot of corn that was water mulched. Clear plastic mulching was also tested with intermediate results. Sweet corn, a heat-sensitive crop, was used to determine how well the water mulch cut down variations in soil temperatures.

PN–1535

PN-1536

Civil engineer Eddie Barbre of USDA's Soil Conservation Service pours dye into the model channel. The dye streams show the path of the flow at the junction.

Model Cuts Cost of . . .

FLOOD CONTROL

ARS ENGINEERS, old hands at researching flood control measures for farmland, turned their attention to urban flood control and saved an Oklahoma community thousands of dollars.

El Reno, Okla. (population 11,015), is situated on the banks of Four Mile Creek, which has a flooding history. In 1953, flood damage to El Reno homes, streets, and business property was estimated at one-quarter of a million dollars. Citizens, deciding to widen and deepen the creek channel, sought help through Public Law 566, a bill that authorizes USDA support of watershed programs other than those of individual farmers.

G. G. Hebaus and W. R. Gwinn, ARS hydraulic engineers stationed at Stillwater, Okla., were requested by Soil Conservation Service specialists to run model tests on the channel improvement plant that had been designed for El Reno. Findings would be incorporated into the final SCS design. Says Hebaus:

"In rural areas, where space is available and right-of-way is not too expensive, channel improvement can be laid out in straight lines or with gently curving bends. In El Reno, the creek channel is bordered by homes, streets, and railroad property. The main channel and a tributary meet in a pattern of sharp bends. Trestle bridges and an exposed sewer pipe cross the channel. These conditions made it difficult to predict the hydraulic performance of proposed improvements."

The problem—finding out if the proposed improvements would work or not—was solved by constructing a 1- to 40-scale replica of the portion of creek under study, plus the bridges, roads, and other structures that would be affected by the project.

To test scour potential, the scientists ran water through the model at a rate equivalent to 5 days of peak flow through the original creek and determined the size and amount of stone riprap that would keep the streambed stable. They put dye in the water to determine points of flow reversal and stagnation, and used this data to improve the design of a culvert approach and outlet.

Experiments showed that Four Mile Creek can be tamed with less work than was originally planned.

Both riprapping and excavating costs can be reduced from earlier estimates, the researchers found. Also, less right-of-way will be needed. The original design, though generally sound, would have cost about $21,500 more than the design based on the model's performance and would have provided no more protection against flooding, Hebaus said.

Cooperators in the research were the Oklahoma Agricultural Experiment Station and the Soil Conservation Service.

The construction work is expected to be completed sometime in 1969.■

ST-2151-10

ARS animal biologist J. A. McCann sprays an experimental dog repellent on a specially rigged garbage can. If a dog nudges the lid, which is connected by chain to a lever, the lever will activate a recording device, thus providing data on the effectiveness of the repellent.

Do Repellents

HELP PETS BEHAVE?

How effective are the dog repellents used to change a pet's bad habits?

To find out, ARS scientists are evaluating several of the aromatic oils such as lemongrass oil and oil of mustard most commonly used in commercial repellents.

ARS scientists are evaluating several of the aromatic oils such as lemongrass oil and oil of mustard most commonly used in commercial repellents.

Observations of the dogs' behavior indicate that some repellents may be misnamed because they do not always appear to irritate the dogs' nostrils or cause them to flee the sprayed area. Rather, the materials seem to mask the natural odors of the garbage pails and urination posts.

Some dogs react to the repellent by using a treated post as though they were deliberately trying to overcome the masking effect of the repellent. This indicates that attacking a dog's sense of smell may not alone change the animal's behavior.

Animal biologists J. A. McCann and J. A. Ludeman at Beltsville, Md., developed electrical recording devices and rigged tests areas that dogs visit for food or urination so that the test dogs—mongrels that run the gamut of behavioral traits of various dog breeds—unwittingly record their reactions to various repellents.

In tests with garbage pails connected electrically to a nearby recording device, for example, dogs are given a choice of pails from which they can obtain their regular diets. After the dogs get used to eating from the pails, McCann and Ludeman spray one of the preferred pails with a repellent and check to see if the dogs ignore or avoid the treated pail.

Similar devices record dog activities at doghouses, posts, and other locations.

McCann and Ludeman believe, however, that almost any bad habit can be broken if a dog is given adequate training. Repellents are helpful training aids when used so Fido associates them with undesired behavior. A flowerbed, for example, should be sprayed with a repellent at the same time Fido is scolded for digging it up; the lingering odor of the repellent will be a future reminder of his unpleasant scolding and help him learn to stay away from the treated area.

Unfortunately, the dogs with the undesirable habits usually belong to "someone else," and training of all neighborhood dogs is not likely. Therefore, the biologists are continuing to test the new and currently-available chemicals with the methods they have devised to determine whether the claim "repellent" is justified.■

Compacting Fibers for Better Cottons

"CLOSE RANKS!" When a drill sergeant gives this order, men standing at arm's length close in shoulder-to-shoulder while maintaining normal distance between ranks.

Something similar happens to fibers in cotton fabric when ARS cotton utilization scientists put wet fabric through a series of curved rubber rollers. Fibers running the length of the fabric (the warp yarns) are gently pushed closer together.

The rollers decrease the total width of the fabric by increasing the height of the crimp, or waves, of the individual crosswise (filling) yarns as they go over the lengthwise (warp) yarns.

The procedure, called compacting, may result in cotton stretch fabrics that are stronger and less expensive than present stretch cottons and may also be a way to make durable-press garments wear longer.

Conducting the research at ARS's Southern utilization research laboratory in New Orleans are technologist W. G. Sloan, chemist A. S. Cooper, Jr., and technicians M. J. Hoffman and A. M. Walker. They say much additional research is needed before the process will be ready for commercial application.

To impart stretch to cotton fabric by present methods, crimp or waves in the yarn are enlarged by one chemical treatment and then "locked" in place by a second and different chemical treatment—all with some loss of fabric strength. The ARS research team believes that a combination of mechanical and chemical treatments may result in stronger fabrics with greater stretch than can now be achieved.

Mechanical compaction in the warp direction, which can be accomplished by several methods, improves fabric resistance to abrasion damage. The reseachers are hopeful that compacting fabrics in both directions will produce even greater abrasion resistance. This could help solve the problem of excessive abrasion damage in all-cotton durable press garments.

Why compacting a fabric should increase its abrasion resistance is not yet known, but it is believed that yarns in compacted fabrics are more bulky and may be able to move more freely. The yarns are then less likely to chafe when rubbed together or against another surface. Imparting stretch to cotton fabric increases its toughness and the scientists believe this, too, may play an important part in increasing abrasion resistance.■

Miniature Monkeys: Human Substitutes

TAMARINS, MINIATURE monkeys of the marmoset family no larger than rats, are serving as substitutes for human test subjects in human allergy research.

Marmosets are abundant in South America and cost only about one-third as much as other suitable monkeys.

Biochemist L. L. Layton at the ARS Western utilization research laboratory, Albany, Calif., developed the monkey test for human allergies earlier during studies of castorbean meal allergy (AGR. RES., July 1963, p. 3).

Using monkeys eliminates the hazards of diagnosing human allergies by traditional methods. The conventional scratch test on the patient can cause a serious allergic shock, and another diagnostic approach—injecting the patient's blood serum into a human volunteer's skin — could transmit serum hepatitis from the patient to the volunteer.

In Layton's allergy test, monkeys are injected with blood serum from human allergy victims and then exposed to agents that may cause the allergies such as castorbean meal, ragweed pollen, or penicillin.

Such exposure will cause an allergic reaction in the monkey's skin and mucous membranes. Scientists can study and evaluate these allergic reactions as models of the human reactions.■

PN–1537

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON, D.C. 20402

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AGRISEARCH NOTES

Better Stands of Sericea

Broadcasting produces better and higher yielding stands of Sericea in pastures and fields than does planting the seed with a drill. And broadcast Sericea plants are smaller, with more tender stems.

A 3-year study to determine how seed and fertilizer placement and level affect Sericea was conducted by ARS agricultural engineer C. W. Gantt and by agronomist E. D. Donnelly and data analyst R. M. Patterson of the Alabama Agricultural Experiment Station, Auburn.

In the experiments, commercial Sericea and a synthetic experimental variety, much like the present variety Serala, were seeded each year at a rate of 30 pounds per acre. Seed was either broadcast and covered with a double-corrugated roller or planted with a drill in 8-inch rows and covered ¼-inch deep.

Fertilizer was broadcast or banded 1 inch below the seed and applied at the rates of 40 pounds of phosphorous and 20 pounds of potash per acre or 80 pounds of phosphorous and 40 pounds of potash per acre. Tests included a check plot on which no fertilizer was used. Stands and tillering were recorded during the seeding year and during the harvest year.

Sericea yields were 30 percent higher under all treatments when the seed was broadcast than when it was planted in drill rows.

The two varieties responded alike to the various treatments, but the experimental variety tillered more profusely than the commercial variety under all conditions. Yields were increased by fertilizer but there were few differences between the two rates. Stands and tillering were not greatly affected by fertilizer placements or rates.

Double Treatment for Durable Press

Treating cotton fabrics first with water-resistant chemicals, then with the conventional durable-press treatment, may improve wearability of durable-press cotton fabrics.

In tests at the ARS Southern utilization research laboratory, New Orleans, trouser cuffs given the experimental treatment stood up better in home-type launderings (wash and tumble-dry) than cuffs given only the conventional durable-press treatment.

Chemists T. A. Calamari and A. S. Cooper, Jr., and technicians S. P. Schreiber and A. M. Walker are conducting the research. They caution that several problems must be solved before the treatment is ready for commercial application. In its present form, the treatment does not produce enough improvement in durable-press performance to warrant large-scale experiments in commercial finishing plants.

Exactly what water-resisting chemicals such as ammonium stearate and zirconyl ammonium carbonate do inside the cotton fiber is unknown. The researchers theorize that the chemicals react in the cotton fiber in the same places sought by durable-press chemicals. Then, when durable-press chemicals are added, they are forced to find new locations to crosslink, or tie molecules together. The new location of the crosslinks may be the reason for improved performance.

Inexpensive chemicals and standard textile finishing equipment of the type used to apply durable-press chemicals are used in the first treatment. Fabric is wetted in the chemicals, dried and heated. Heating decomposes the chemicals to yield stearic acid and zirconium oxide, the water-resisting agents.

Correction: Plus-Charged Flour

Chemists made the plus-charged flour by reacting dry flour with ethylene imine, not with ethylene imide as incorrectly stated on page 13 of the June 1967 issue.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

U.S. GOVERNMENT PRINTING OFFICE: 1967